CELL STRUCTURE OF SOLID POLYMER ELECTROLYTIC FUEL CELL

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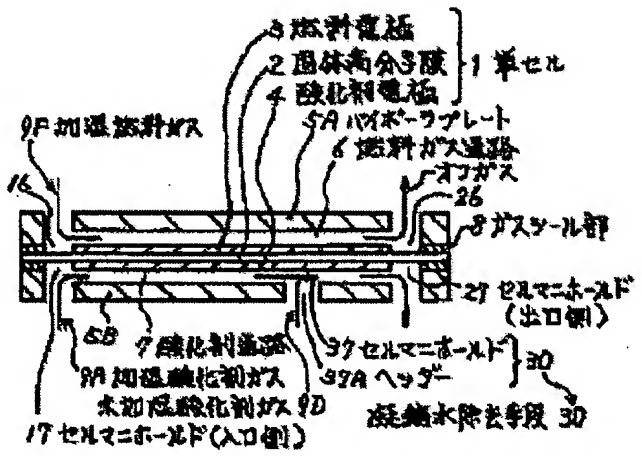
Abstract of **JP6068886**

PURPOSE:To prevent failure in the supply of oxidant gas, and reduction in the power generation performance caused thereby by preventing water condensation on the lower stream side of an oxidant channel.
CONSTITUTION:A solid polymer electrolytic fuel cell comprises a stack alternately consisting of a solid polymer film 2 having ion conductivity, fuel electrodes 3 connected to the both surfaces of the film 2, a unit cell 1 consisting of an oxidant electrode 4, fuel gas channels 6 formed as a recessed groove on both surfaces of a gas non-permeation plate, and of a bipolar plate 5 having an oxidation agent channel 7. A moisture fuel gas 9F and a moisture oxidant gas 9A are fed through inlet side cell manifolds 16, 17 of the fuel gas channel and of the oxidant channel, and a solid polymer film formed during the operation is prevented from being dried. A condensed water removal means 30 for feeding a non-humidification oxidant gas 9D is provided in the middle of the oxidant channel 7.



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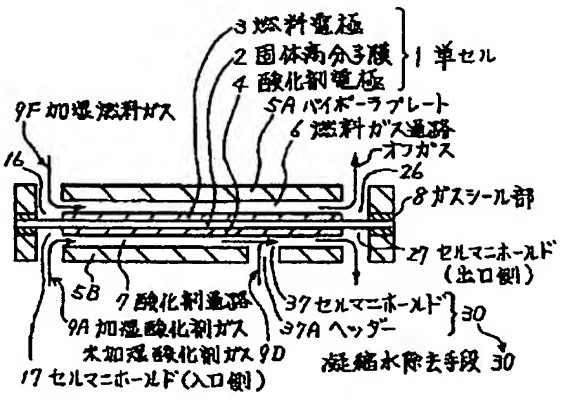
(54)【発明の名称】　固体高分子電解質型燃料電池のセル構造

(57)【要約】

【目的】酸化剤通路下流側での水分の凝縮を防止することにより、酸化剤ガスの供給障害、およびこれに起因する発電性能の低下を防止する。

【構成】イオン導電性を有する固体高分子膜２およびその両面に結合した燃料電極３，酸化剤電極４からなる単セル１と、ガス不透過性板の両面に凹溝として形成した燃料ガス通路６および酸化剤通路７を有するバイポーラプレート５とを交互に積層したスタックからなり、燃料ガス通路および酸化剤通路の入口側セルマニホールド１６，１７を介して加湿燃料ガス９Ｆ，加湿酸化剤ガス９Ａを供給し、運転中発生する固体高分子膜の乾燥を防止するよう形成された固体高分子電解質型燃料電池において、酸化剤通路７の流路の途中に未加湿酸化剤ガス９Ｄを供給する凝縮水除去手段３０を設ける。



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【特許請求の範囲】

【請求項1】イオン導電性を有する固体高分子膜およびその両面に密着して配された燃料電極および酸化剤電極からなる単セルと、ガス不透過性板の両面に凹溝として形成した燃料ガス通路および酸化剤通路を有するバイポーラプレートとを交互に積層したスタックからなり、前記燃料ガス通路および酸化剤通路それぞれの入口側セルマニホールドからあらかじめ加湿された燃料ガスおよび酸化剤ガスを供給し、運転中発生する前記固体高分子膜の乾燥を防止するよう形成されたものにおいて、前記酸化剤通路の流路の途中に未加湿の酸化剤ガスを供給する凝縮水除去手段を備えてなることを特徴とする固体高分子電解質型燃料電池のセル構造。

【請求項2】凝縮水除去手段が、酸化剤通路を横断する方向にバイポーラプレートに形成されたセルマニホールドと、その端部に連通する分岐部を持ちスタックのシール部を積層方向に貫通する一対の入口側ヘッダーとからなることを特徴とする請求項1記載の固体高分子電解質型燃料電池のセル構造。

【請求項3】凝縮水除去手段が、酸化剤通路を横断する方向にバイポーラプレート内に形成された未加湿酸化剤ガスの流通孔と、その長手方向に分布して酸化剤通路に連通するよう形成された噴出孔と、前記流通孔の両端部に連通する分岐部を持ちスタックのシール部を積層方向に貫通するヘッダーとからなることを特徴とする請求項1記載の固体高分子電解質型燃料電池のセル構造。

【発明の詳細な説明】

【0001】

【産業上の利用分野】この発明は、固体高分子膜を電解質膜として用いた固体高分子電解質型燃料電池スタック、ことにあらかじめ加湿した反応ガスの供給を受ける固体高分子電解質型燃料電池スタックにおける酸化剤電極の過度の湿潤を防止するセル構造に関する。

【0002】

【従来の技術】図5は固体高分子電解質型燃料電池の単セル構造を模式化して示す断面図であり、単セル1は、イオン導電性を有する固体高分子膜2と、その両面に密着するよう支持された燃料電極（アノード電極）3および酸化剤電極（カソード電極）4とで構成される。また、単セル1を挟持するバイポーラプレート5は導電性を有するガス不透過性板からなり、その燃料電極3に接する面側に凹溝として形成された燃料ガス通路6に燃料ガスとしての水素を、酸化剤電極4に接する面側に凹溝として形成された酸化剤通路7に酸化剤としての酸素（または空気）を供給することにより、単セル1の一対の電極間で電気化学反応に基づく発電が行われる。なお、このように構成された単セル1の出力電圧は1V以下と低いので、単セル1とバイポーラプレート5A，5B等5を複数層積層してスタックを構成することにより、所望の出力電圧の固体高分子電解質型燃料電池（スタック）が得られる。

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【0003】一方、イオン導電性を有する固体高分子膜1としては、例えばプロトン交換膜であるパーフロロカーボンスルホン酸膜（米国，デュポン社，商品名ナフィオン）を電解質膜として用いたものが知られており、分子中にプロトン（水素イオン）交換基を持ち、飽和含水することにより常温で20Ω-cm 以下の比抵抗を示し、プロトン導電性電解質として機能するとともに、燃料ガスと酸化剤ガスの混合を防ぐ隔膜としても機能する。すなわち、アノード電極（燃料電極）側では水素分子を水素イオンと電子に分解するアノード反応（$H_2 \rightarrow 2H^+ + 2e^-$）が、カソード電極（酸化剤電極）側では酸素と水素イオンと電子から水を生成する電気化学反応（$2H^+ + 1/2\ O_2 + 2e^- \rightarrow H_2O$）なるカソード反応がそれぞれ行われ、全体として$H_2 + 1/2\ O_2 \rightarrow H_2O$なる電気化学反応が行われ、アノードからカソードに向かって外部回路を移動する電子により発電電力が負荷に供給される。

【0004】上述のように、固体高分子電解質型燃料電池では、電解質膜を飽和含水させることにより、膜はプロトン交換膜として機能するものであるから、固体高分子電解質型燃料電池の発電効率を高く維持するためには固体高分子膜2中を飽和含水状態に維持するとともに、固体高分子電解質型燃料電池の運転温度を50～100°C 程度に保持して固体高分子膜の比抵抗を低く保つ必要がある。このため、各単セル1の固体高分子電解質膜2はあらかじめ飽和量の水を含水させた状態でスタックの組立作業が行われる。ところが、運転温度を上記温度範囲に高めて発電を行うと、下記に示す固体高分子膜2の乾燥作用が発生し、固体高分子膜2を飽和含水状態に維持できず固体高分子電解質型燃料電池の発電効率が低下するという問題が発生する。すなわち、燃料ガスおよび酸化剤ガスにより電気化学反応で生成した水が系外に持ち出されるとともに、アノード反応において生成したプロトン$2H^+$が固体高分子膜中をアノードからカソードに向けて移動する際、プロトンに数分子の水が配向して一緒に移動し、燃料ガス，酸化剤ガスとともに系外に持ち出されることにより、固体高分子膜の乾燥が進行する。

【0005】そこで、このような事態を回避するために、反応ガス通路6および7に供給する反応ガス（燃料ガスおよび酸化剤）を加湿して反応ガス中の水蒸気濃度（水蒸気分圧）を高め、固体高分子膜2からの水分の蒸発を抑えるよう構成したものが知られている。図6は反応ガスの加湿方式を示すブロック図であり、固体高分子電解質型燃料電池スタック10の外部あるいは隣接して加湿部11を設けて燃料ガスまたは酸化剤ガスを加湿し、加湿燃料ガス9Fまたは加湿酸化剤ガス9Aとして各単セルに供給するよう構成される。

【0006】

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【発明が解決しようとする課題】固体高分子電解質型燃料電池は前述の反応式からも分かるように、プロトン導電性の固体高分子膜を電解質膜として用いた場合には、生成水が酸化剤電極（カソード）側に発生するとともに、プロトンに数分子の水が配向して燃料電極（アノード）から酸化剤電極（カソード）に向けて移動する。このため、加湿燃料ガス９Ｆおよび加湿酸化剤ガス９Ａを供給する従来の固体高分子電解質型燃料電池では、酸化剤通路７側，ことに酸化剤通路の下流側では、上流側で発生する生成水が加湿酸化剤ガス９Ａに加わるために水分が過剰となり、過飽和状態となった酸化剤ガス中の水分が凝縮して酸化剤通路７の内壁面に付着する。その結果、本来ガス透過性であるべき酸化剤電極４の基材層の空孔が凝縮した水分によって閉塞されて酸化剤ガスの供給障害が起こり、これが原因で固体高分子電解質型燃料電池の発電性能が低下するという問題があり、その改善が求められている。

【０００７】この発明の目的は、酸化剤通路下流側での水分の凝縮を防止することにより、酸化剤ガスの供給障害、およびこれに起因する発電性能の低下を防止することにある。

【０００８】

【課題を解決するための手段】上記課題を解決するために、この発明によれば、イオン導電性を有する固体高分子膜およびその両面に密着して配された燃料電極および酸化剤電極からなる単セルと、ガス不透過性板の両面に凹溝として形成した燃料ガス通路および酸化剤通路を有するバイポーラプレートとを交互に積層したスタックからなり、前記燃料ガス通路および酸化剤通路それぞれの入口側セルマニホールドからあらかじめ加湿された燃料ガスおよび酸化剤ガスを供給し、運転中発生する前記固体高分子膜の乾燥を防止するよう形成されたものにおいて、前記酸化剤通路の流路の途中に未加湿の酸化剤ガスを供給する凝縮水除去手段を備えてなるものとする。

【０００９】また、凝縮水除去手段が、酸化剤通路を横断する方向にバイポーラプレートに形成されたセルマニホールドと、その端部に連通する分岐部を持ちスタックのシール部を積層方向に貫通する一対の入口側ヘッダーとからなるものとする。さらに、凝縮水除去手段が、酸化剤通路を横断する方向にバイポーラプレート内に形成された未加湿酸化剤ガスの流通孔と、その長手方向に分布して酸化剤通路に連通するよう形成された噴出孔と、前記流通孔の両端部に連通する分岐部を持ちスタックのシール部を積層方向に貫通するヘッダーとからなるなるものとする。

【００１０】

【作用】この発明の構成において、酸化剤通路の流路の途中に未加湿の酸化剤ガスを供給する凝縮水除去手段を設けるよう構成したことにより、凝縮水除去手段から供給される乾燥した酸化剤ガスが上流側からの湿った酸化剤ガスに加わり、これより下流の酸化剤ガス中の水蒸気分圧を低下させるので、酸化剤ガスの過飽和状態が解消され、酸化剤通路の内壁面への水分の凝縮を防止できるとともに、凝縮水の蒸発が促され、酸化剤電極触媒層への酸化剤ガスの供給障害を防止する機能が得られる。

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【００１１】また、凝縮水除去手段を例えば、シール部を積層方向に貫通するヘッダーと、これに連通した凹溝からなるセルマニホールドとで構成すれば、バイポーラプレートにあらかじめ形成される凹溝およびヘッダー孔の多少の変更により、固体高分子電解質型燃料電池の積層構造を大幅に変更することなく凝縮水除去手段を容易に形成できる。

【００１２】さらに、凝縮水除去手段を例えば、酸化剤通路に連通する噴出孔を有する未加湿酸化剤ガスの流通孔、およびその両端に連通したヘッダーとで構成すれば、乾燥した酸化剤ガスを酸化剤通路中に分布供給できるので、酸化剤ガスの水蒸気分圧を均等に低減し、水分の凝縮をよりよく防止する機能が得られる。

【００１３】

【実施例】以下、この発明を実施例に基づいて説明する。図１はこの発明の実施例になる固体高分子電解質型燃料電池のセル構造を模式化して示す断面図であり、以下従来技術と同じ構成部分には同一参照符号を付すことにより、重複した説明を省略する。図１において、プロトン導電性を有する固体高分子膜１の両面に燃料電極３および酸化剤電極４を接合した単セル１は、その燃料電極側に積層されたバイポーラプレート５Ａに凹溝として燃料ガス通路６，入口側セルマニホールド１６，および出口側セルマニホールド２６が形成され、加湿燃料ガス９Ｆが入口側セルマニホールド１６を介して燃料ガス通路６に供給され、燃料電極に拡散した水素がアノード反応に寄与するとともに、燃料ガスが高い水蒸気分圧を保持することにより固体高分子膜の乾燥が阻止される。また、酸化剤電極側に積層されたバイポーラプレート５Ｂに凹溝として酸化剤通路７，入口側セルマニホールド２７，および出口側セルマニホールド２７が形成され、加湿酸化剤ガス９Ａが入口側セルマニホールド１７を介して酸化剤通路７に供給され、酸化剤電極に拡散した酸素がカソード反応に寄与するとともに、酸化剤ガス９Ａが高い水蒸気分圧を保持することによって酸化剤通路の上流部分での固体高分子膜の乾燥が阻止される。

【００１４】さらに、酸化剤電極側に積層されたバイポーラプレート５Ｂの酸化剤通路７の中間位置には、酸化剤通路を横断する方向に形成された凹溝からなるセルマニホールド３７と、その両端に連通して未加湿酸化剤ガス９Ｄを供給するヘッダー３７Ａとからなる凝縮水除去手段３０が形成され、未加湿酸化剤ガス９Ｄがこの凝縮水除去手段３０を介して酸化剤通路７内に供給され、上流側で生成水が発生することにより水分が過剰となった酸化剤ガスに乾燥した酸化剤ガス９Ｄを混合し、水蒸気

分圧が低下した酸化剤ガスが下流側に流れることにより、酸化剤通路７の内壁面に凝縮水が付着するのを防止するよう構成される。

【００１５】図２は実施例におけるバイポーラプレートを酸化剤通路側から見た平面図、図３は図２におけるＡ－Ａ方向の断面図であり、バイポーラプレート５Ｂの酸化剤通路７は、その外周部分にシール部８を残し，かつ酸化剤通路内に集電用リブ１８を残した凹溝として形成され、その最上流側に入口側セルマニホールド１７，最下流側に出口側セルマニホールド２７，両者の中間に未加湿酸化剤ガス９Ｄ供給用のセルマニホールド３７が、酸化剤通路より深い凹溝として形成され、各セルマニホールドの両端部はシール部８にスタックを積層方向に貫通する孔として形成されたヘッダー１７Ａ，２７Ｂ，および３７Ａに連通することにより、酸化剤ガスの供給，排出が可能になる。

【００１６】このように構成された凝縮水除去手段を有する固体高分子電解質型燃料電池スタックにおいて、加湿酸化剤ガス９Ａはヘッダー１７Ａ内で各単セル１のセルマニホールド１７に分配されて酸化剤通路７に流入し、酸素の消費によりそのガス量が徐々に減少するとともに生成水が発生して水分量が徐々に増した状態となる。そこで、酸化剤ガス中の水蒸気が過飽和状態となる位置より幾分上流側に凝縮水除去手段３０を設け、ヘッダー３７Ａで各単セルのセルマニホールド３７に未加湿の酸化剤ガス９Ｄを分配して酸化剤通路内で上流側からの酸化剤ガスと混合すれば、酸化剤ガス中の水蒸気濃度を未飽和状態に低減できるので、酸化剤通路７の内壁面に水分が凝縮して付着し、これが原因で酸化剤電極４への酸素の供給障害が発生することを阻止できるとともに、既に凝縮した水を蒸発させ、出口側のセルマニホールド２７およびヘッダー２７Ｂを介して過剰な水分をオフガスとともに外部に排出することができる。

【００１７】なお、酸化剤通路内での酸化剤ガス中の水分量の分布は、単セル１の電極面積，加湿酸化剤ガス９Ａの供給量やその加湿状態によって変化するので、凝縮水除去手段３０の位置および未加湿酸化剤ガス９Ｄの供給量は、酸化剤通路７内での水分量の分布状態を勘案して最適位置および量を決めてよく、かつ必要に応じて複数箇所に設けるよう構成されてよい。

【００１８】図４はこの発明の異なる実施例を示すバイポーラプレートの平面図であり、酸化剤電極側のバイポーラプレート４５Ｂに形成された凝縮水除去手段４０が、スタックをその積層方向に貫通する未加湿酸化剤ガス９Ｄ供給用のヘッダー４７Ａと、これに両端が連通するようバイポーラプレート４５Ｂ内に沿厚方向にトンネル状に形成された未加湿酸化剤ガス９Ｄの流通孔４７と、その長手方向に分散して形成された未加湿酸化剤ガスの噴出孔４８とで構成された点が前述の実施例と異なっており、このように構成することにより、酸化剤通路

内に分布して噴出した未加湿酸化剤ガス９Ｄが、上流側からの湿った酸化剤ガスとよく混合され、酸化剤ガスの水蒸気分圧を均一に低減し、凝縮水の発生および除去をより確実に行える利点が得られる。

【００１９】

【発明の効果】この発明は前述のように、酸化剤通路の流路の途中に未加湿の酸化剤ガスを供給する凝縮水除去手段を設けるよう構成したことにより、凝縮水除去手段から供給される乾燥した酸化剤ガスが上流側からの湿った酸化剤ガスに加わり、これより下流の酸化剤ガス中の水蒸気分圧を低下させるので、電極反応により酸化剤電極側に生成した水が加湿酸化剤ガスに加わることによって酸化剤ガス中の水分が過飽和状態になるという従来技術の問題点が解消され、酸化剤通路の内壁面への水分の凝縮を防止できるとともに、凝縮水の蒸発が促され、酸化剤電極触媒層への酸化剤ガスの供給障害と、これに起因する発電性能の低下とが排除された信頼性の高い固体高分子電解質型燃料電池を提供することができる。

【図面の簡単な説明】

【図１】この発明の実施例になる固体高分子電解質型燃料電池のセル構造を模式化して示す断面図

【図２】実施例におけるバイポーラプレートを酸化剤通路側から見た平面図

【図３】図２におけるＡ－Ａ方向の断面図

【図４】この発明の異なる実施例を示すバイポーラプレートの平面図

【図５】固体高分子電解質型燃料電池の単セル構造を模式化して示す断面図

【図６】反応ガスの加湿方式を示すブロック図

【符号の説明】

１　単セル
２　固体高分子膜（プロトン交換膜）
３　燃料電極
４　酸化剤電極
５Ａ　燃料電極側のバイポーラプレート
５Ｂ　酸化剤電極側のバイポーラプレート
６　燃料ガス通路
７　酸化剤通路
８　シール部
９Ａ　加湿酸化剤ガス
９Ｆ　加湿燃料ガス
９Ｄ　未加湿酸化剤ガス
１０　スタック
１１　加湿部
１６　セルマニホールド（燃料ガス入口側）
２６　セルマニホールド（オフガス出口側）
１７　セルマニホールド（酸化剤ガス入口側）
１７Ａ　ヘッダー（酸化剤ガス入口側）
２７　セルマニホールド（オフガス出口側）
２７Ｂ　ヘッダー（オフガス出口側）

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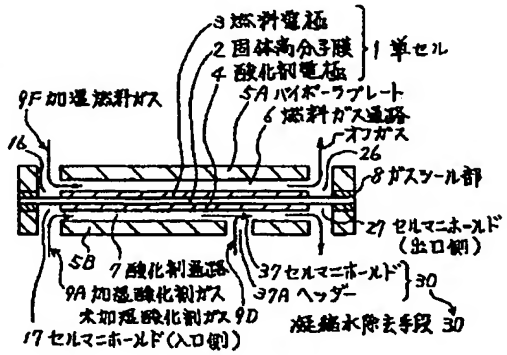
30　凝縮水除去手段
37　セルマニホールド（凝縮水除去手段側）
37A　ヘッダー（未加湿酸化剤ガス供給側）
40　凝縮水除去手段

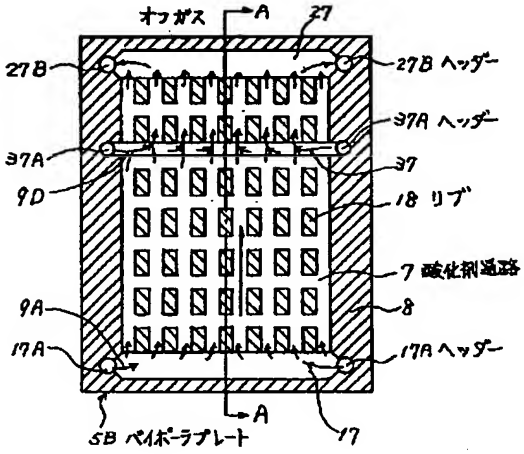
8

45B　酸化剤電極側バイポーラプレート
47　未加湿酸化剤ガスの流通孔
47A　ヘッダー（未加湿酸化剤ガス供給側）
48　噴出孔

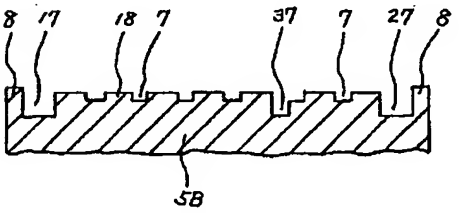
【図1】



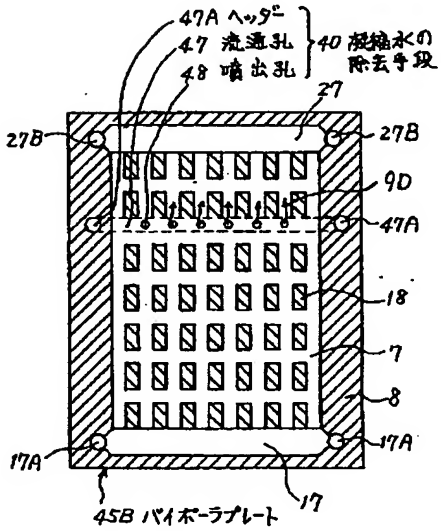
【図2】



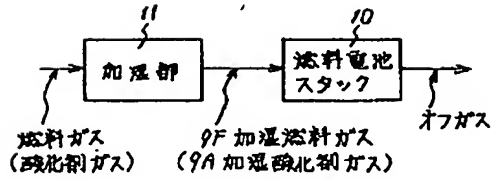
【図3】



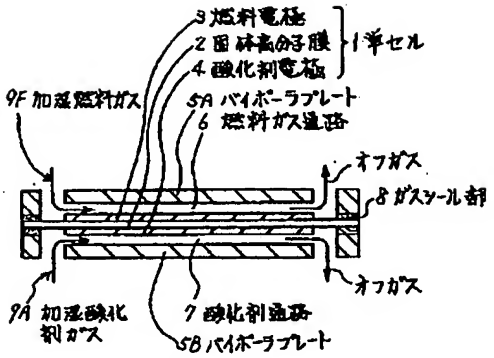
【図4】



【図6】



【図5】


3 燃料電極
2 固体高分子膜
4 酸化剤電極
1単セル
9F 加湿燃料ガス
5A バイポーラプレート
6 燃料ガス通路
オフガス
8 ガスシール部
オフガス
9A 加湿酸化剤ガス
7 酸化剤通路
5B バイポーラプレート

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]A single cell which consists of a fuel electrode and an oxidant electrode which were arranged by sticking to solid polymer membrane which has ion conductivity, and its both sides.
A fuel gas passage and an oxidizing agent passage which were formed in both sides of a gas impermeability board as a concave.
It has a water-of-condensation elimination means which is the cellular structure of a solid polyelectrolyte type fuel cell provided with the above, and supplies unhumidified oxidant gas in the middle of a channel of said oxidizing agent passage.

[Claim 2]The cellular structure of the solid polyelectrolyte type fuel cell according to claim 1 characterized by comprising the following.
A cell manifold formed in the direction in which a water-of-condensation elimination means crosses an oxidizing agent passage at a bipolar plate.
An entrance-side header of a couple which penetrates a seal part of a stack to a laminating direction with a tee which is open for free passage at the end.

[Claim 3]The cellular structure of the solid polyelectrolyte type fuel cell according to claim 1 characterized by comprising the following.
A circulating hole of unhumidified oxidant gas with which a water-of-condensation elimination means was formed in a bipolar plate in the direction which crosses an oxidizing agent passage.
A jet hole formed so that it might be distributed over the longitudinal direction and might be open for free passage to an oxidizing agent passage.
A header which penetrates a seal part of a stack to a laminating direction with a tee which is open for free passage to both ends of said circulating hole.

[Translation done.]

* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the cellular structure which prevents the excessive humidity of the oxidant electrode in the solid polyelectrolyte type fuel cell stack which used solid polymer membrane as an electrolyte membrane, and the solid polyelectrolyte type fuel cell stack which receives supply of the reactant gas humidified especially beforehand.
[0002]
[Description of the Prior Art]Drawing 5 is a sectional view [-izing / **/ the single-cell-structure of a solid polyelectrolyte type fuel cell / a sectional view / type / in which showing it] and and, and the single cell 1 comprises the solid polymer membrane 2 which has ion conductivity, and the fuel electrode (anode electrode) 3 and the oxidant electrode (cathode terminal) 4 which were supported so that it might stick to the both sides. The bipolar plate 5 which pinches the single cell 1 consists of a gas impermeability board which has conductivity, By supplying oxygen (or air) as an oxidizer to the oxidizing agent passage 7 formed in the fuel gas passage 6 formed in the field side which touches the fuel electrode 3 as a concave as a concave in hydrogen as fuel gas at the field side which touches the oxidant electrode 4, Power generation based on electrochemical reaction is performed by inter-electrode [of the couple of the single cell 1]. Since the output voltage of the single cell 1 constituted in this way is as low as less than 1V, the solid polyelectrolyte type fuel cell (stack) of desired output voltage is obtained by the single cell 1, the bipolar plates 5A and 5B, etc. laminating 5 [two or more layers], and constituting a stack.
[0003]On the other hand as the solid polymer membrane 1 which has ion conductivity, For example, the thing using the perphloro carbon sulfonic acid film (the U.S., Du Pont, trade name Nafion) which is proton exchange membrane as an electrolyte membrane is known, While the specific resistance of 20 or less ohm-cm is shown and functioning as a proton conductivity electrolyte at ordinary temperature by having and carrying out the saturation water of the proton (hydrogen ion) exchange group into a molecule, it functions also as barrier membrane which prevents mixing of fuel gas and oxidant gas. Namely, the anode reaction ($H_2 \rightarrow 2H^+ + 2e^-$) which decomposes a hydrogen content child into a hydrogen ion and an electron in the anode electrode (fuel electrode) side, in the cathode terminal (oxidant electrode) side, water is generated from oxygen, a hydrogen ion, and an electron -- electrochemical reaction ($2H^+ + 1/2\ O_2 + 2e^- \rightarrow H_2O$) -- a cathode reaction being performed, respectively and, Electrochemical reaction which $2\ O_2 \rightarrow H_2O$ [$H_2 + 1/$] Becomes as a whole is performed, and generated output is supplied to load with the electron which moves toward a cathode in an external circuit from an anode.
[0004]As mentioned above, **********, While maintaining the inside of the solid polymer membrane 2 to a saturation moisture state in order to maintain highly the generation efficiency of a solid polyelectrolyte type fuel cell since a film functions as proton exchange membrane by carrying out the saturation water of the electrolyte membrane, It is necessary to hold the operating

temperature of a solid polyelectrolyte type fuel cell to a 50-100 degreeC grade, and to keep the specific resistance of solid polymer membrane low. For this reason, after the solid polyelectrolyte membrane 2 of each single cell 1 has carried out the water of the water of a saturation content beforehand, assembly operation of a stack is performed. However, if it generates electricity by raising an operating temperature to the above-mentioned temperature requirement, the drying effect of the solid polymer membrane 2 shown below occurs, the solid polymer membrane 2 cannot be maintained to a saturation moisture state, but the problem that the generation efficiency of a solid polyelectrolyte type fuel cell falls will occur. Namely, while the water generated by electrochemical reaction with fuel gas and oxidant gas is carried out out of a system, When proton $2H^+$ generated in the anode reaction turns the inside of solid polymer membrane to a cathode from an anode and moves, desiccation of solid polymer membrane advances by a child's water carrying out orientation to a proton several minutes, moving to it together, and being carried out out of a system with fuel gas and oxidant gas.

[0005]Then, in order to avoid such a situation, the reactant gas (fuel gas and oxidizer) supplied to the reactant gas passages 6 and 7 is humidified, the steam concentration (steam partial pressure) in reactant gas is raised, and what was constituted so that evaporation of the moisture from the solid polymer membrane 2 might be suppressed is known. drawing 6 is a block diagram showing the humidification method of reactant gas -- the exterior of the solid polyelectrolyte type fuel cell stack 10 -- or the humidifying section 11 is formed adjacently and fuel gas or oxidant gas is humidified, and it is constituted so that each single cell may be supplied as the humidification fuel gas 9F or the humidification oxidant gas 9A.

[0006]

[Problem(s) to be Solved by the Invention]As a solid polyelectrolyte type fuel cell shown also in the above-mentioned reaction formula, when the solid polymer membrane of proton conductivity is used as an electrolyte membrane, While being generated by produced water in the oxidant electrode (cathode) side, a child's water carries out orientation to a proton several minutes, and it moves towards an oxidant electrode (cathode) from a fuel electrode (anode). For this reason, in the conventional solid polyelectrolyte type fuel cell which supplies the humidification fuel gas 9F and the humidification oxidant gas 9A. In the downstream of an oxidizing agent passage, since the produced water by which it is generated in the upstream is added to the humidification oxidant gas 9A, the moisture in the oxidant gas with which moisture became superfluous and was in the supersaturation state condenses to things, and the oxidizing agent passage 7 side adheres to them at the internal surface of the oxidizing agent passage 7. As a result, it is blockaded by the moisture which the hole of the base material layer of the oxidant electrode 4 which should be gas permeation nature essentially condensed, the supply obstacle of oxidant gas is encountered, there is a problem that the power generation performance of a solid polyelectrolyte type fuel cell falls owing to this, and the improvement is called for.

[0007]The purpose of this invention is to prevent the supply obstacle of oxidant gas, and the fall of the power generation performance resulting from this by preventing condensation of the moisture in the oxidizing agent passage downstream.

[0008]

[Means for Solving the Problem]A single cell which consists of a fuel electrode and an oxidant electrode which were arranged by sticking to solid polymer membrane which has ion conductivity, and its both sides according to this invention in order to solve an aforementioned problem, It consists of a stack which laminated by turns a bipolar plate which has a fuel gas passage and an oxidizing agent passage which were formed in both sides of a gas impermeability board as a concave, In what was formed so that desiccation of said solid polymer membrane which supplies fuel gas and oxidant gas which were humidified beforehand, and is generated during operation from an entrance-side cell manifold of said fuel gas passage and each oxidizing agent passage might be prevented, It has a water-of-condensation elimination means which supplies unhumidified oxidant gas in the middle of a channel of said oxidizing agent passage.

[0009]A water-of-condensation elimination means shall consist of a cell manifold formed in the

direction which crosses an oxidizing agent passage at a bipolar plate, and an entrance-side header of a couple which penetrates a seal part of a stack to a laminating direction with a tee which is open for free passage at the end. A circulating hole of unhumidified oxidant gas with which a water-of-condensation elimination means was formed in a bipolar plate in the direction which crosses an oxidizing agent passage, Let a seal part of a stack be a becoming thing which consists of a header penetrated to a laminating direction with a tee which is open for free passage to both ends of a jet hole formed so that it might be distributed over the longitudinal direction and might be open for free passage to an oxidizing agent passage, and said circulating hole.

[0010]

[Function]By having constituted so that the water-of-condensation elimination means which supplies unhumidified oxidant gas in the middle of the channel of an oxidizing agent passage might be established in the composition of this invention, Since the dry oxidant gas supplied from a water-of-condensation elimination means is added to oxidant gas damp from the upstream and reduces the steam partial pressure in downstream oxidant gas from this, While the supersaturation state of oxidant gas is canceled and being able to prevent condensation of the moisture to the internal surface of an oxidizing agent passage, it is urged to evaporation of the water of condensation, and the function to prevent the supply obstacle of the oxidant gas to an oxidant electrode catalyst bed is obtained.

[0011]If a water-of-condensation elimination means is constituted from a header which penetrates a seal part to a laminating direction, and a cell manifold which consists of a concave which was open for free passage to this, By change of some of concaves beforehand formed in a bipolar plate, and header holes, a water-of-condensation elimination means can be formed easily, without changing substantially the laminated structure of a solid polyelectrolyte type fuel cell.

[0012]Since the distribution supply of the dry oxidant gas can be carried out all over an oxidizing agent passage if constituted from a header which was open for free passage to the circulating hole of the unhumidified oxidant gas which has a jet hole which opens a water-of-condensation elimination means for free passage to an oxidizing agent passage, and its both ends, The steam partial pressure of oxidant gas is reduced uniformly, and the function to prevent condensation of moisture better is obtained.

[0013]

[Example]Hereafter, this invention is explained based on an example. Drawing 1 is a sectional view [-izing / **/ the cellular structure of the solid polyelectrolyte type fuel cell which becomes an example of this invention / a sectional view / type / in which showing it] and and, and the duplicate explanation is omitted by giving the same reference mark to the same component part as conventional technology below. The single cell 1 which joined the fuel electrode 3 and the oxidant electrode 4 to both sides of the solid polymer membrane 1 which has proton conductivity in drawing 1, The fuel gas passage 6, the entrance-side cell manifold 16, and the outlet side cell manifold 26 are formed in the bipolar plate 5A laminated at the fuel electrode side as a concave, The humidification fuel gas 9F is supplied to the fuel gas passage 6 via the entrance-side cell manifold 16, and while the hydrogen diffused in the fuel electrode contributes to an anode reaction, desiccation of solid polymer membrane is prevented by holding a steam partial pressure with high fuel gas. The oxidizing agent passage 7, the entrance-side cell manifold 27, and the outlet side cell manifold 27 are formed in the bipolar plate 5B laminated at the oxidant electrode side as a concave, The humidification oxidant gas 9A is supplied to the oxidizing agent passage 7 via the entrance-side cell manifold 17, and while the oxygen diffused in the oxidant electrode contributes to a cathode reaction, when the oxidant gas 9A holds a high steam partial pressure, desiccation of the solid polymer membrane in the upstream section of an oxidizing agent passage is prevented.

[0014]In the mid-position of the oxidizing agent passage 7 of the bipolar plate 5B laminated at the oxidant electrode side. The cell manifold 37 which consists of a concave formed in the direction which crosses an oxidizing agent passage, The water-of-condensation elimination means 30 which consists of the header 37A which is open for free passage to the both ends, and supplies the unhumidified oxidant gas 9D is formed, The unhumidified oxidant gas 9D is supplied in the oxidizing agent passage 7 via this water-of-condensation elimination means 30, When are generated by produced water in the upstream,

and the oxidant gas 9D which moisture dried to the oxidant gas which became superfluous is mixed and the oxidant gas with which the steam partial pressure fell flows into the downstream, it is constituted so that the water of condensation may be prevented from adhering to the internal surface of the oxidizing agent passage 7.

[0015]Drawing 2 is a sectional view of the direction of A-A in drawing 2, and the top view and drawing 3 which looked at the bipolar plate in an example from the oxidizing agent passage side the oxidizing agent passage 7 of the bipolar plate 5B, Leave the seal part 8 to the peripheral part, and it is formed in an oxidizing agent passage as a concave which left the rib 18 for current collection, To the Mogami style side, the cell manifold 37 for unhumidified oxidant gas 9D supply in the middle of the outlet side cell manifold 27 and both at the entrance-side cell manifold 17 and lowest style side, It is formed as a concave deeper than an oxidizing agent passage, and when the both ends of each cell manifold are open for free passage to the headers 17A, 27B, and 37A formed in the seal part 8 as a hole which penetrates a stack in a laminating direction, supply of oxidant gas and discharge are attained.

[0016]In the solid polyelectrolyte type fuel cell stack which has the water-of-condensation elimination means constituted in this way, The humidification oxidant gas 9A is distributed to the cell manifold 17 of each single cell 1 within the header 17A, flows into the oxidizing agent passage 7, and it will be in the state where it was generated by produced water and the moisture content increased gradually while the gas volume decreases gradually by consumption of oxygen. Then, the water-of-condensation elimination means 30 is formed in the upstream for how many minutes from the position from which the steam in oxidant gas will be in a supersaturation state, Since the steam concentration in oxidant gas can be reduced in the unsaturation state if the unhumidified oxidant gas 9D is distributed to the cell manifold 37 of each single cell by the header 37A and it mixes with the oxidant gas from the upstream in an oxidizing agent passage, While being able to prevent that moisture condenses and adheres to the internal surface of the oxidizing agent passage 7, and the supply obstacle of oxygen to the oxidant electrode 4 occurs owing to this, The already condensed water is evaporated and superfluous moisture can be discharged outside with off-gas via the cell manifold 27 and the header 27B of an outlet side.

[0017]Distribution of the moisture content in the oxidant gas in an oxidizing agent passage, Since it changes with the electrode area of the single cell 1, the amount of supply of the humidification oxidant gas 9A, or its humidified states, the position of the water-of-condensation elimination means 30, and the amount of supply of the unhumidified oxidant gas 9D, It may be constituted so that the distribution state of the moisture content in the oxidizing agent passage 7 may be taken into consideration, and an optimal position and quantity may be decided and it may provide in two or more places if needed.

[0018]Drawing 4 is a top view of the bipolar plate in which the example from which this invention differs is shown, The header 47A for unhumidified oxidant gas 9D supply to which the water-of-condensation elimination means 40 formed in the bipolar plate 45B by the side of an oxidant electrode penetrates a stack to the laminating direction, The circulating hole 47 of the unhumidified oxidant gas 9D formed in the edgewise direction in the bipolar plate 45B at tunnel form so that both ends might be open for free passage to this, By the point which comprised the jet hole 48 of the unhumidified oxidant gas distributed and formed in the longitudinal direction differing from the above-mentioned example, and constituting in this way, The unhumidified oxidant gas 9D which was distributed in the oxidizing agent passage and blew off is well mixed with oxidant gas damp from the upstream, the steam partial pressure of oxidant gas is reduced uniformly, and the advantage which can ensure generating and removal of the water of condensation is acquired.

[0019]

[Effect of the Invention]It constituted from this invention so that the water-of-condensation elimination means which supplies unhumidified oxidant gas in the middle of the channel of an oxidizing agent passage might be established as mentioned above.

Therefore, since the dry oxidant gas supplied from a water-of-condensation elimination means is added to oxidant gas damp from the upstream and reduces the steam partial pressure in downstream oxidant gas from this, While the problem of the conventional technology that the moisture in oxidant gas will be in a supersaturation state when the water generated to the oxidant electrode side by the electrode

reaction is added to humidification oxidant gas is canceled and being able to prevent condensation of the moisture to the internal surface of an oxidizing agent passage, It is urged to evaporation of the water of condensation, and the reliable solid polyelectrolyte type fuel cell with which the supply obstacle of the oxidant gas to an oxidant electrode catalyst bed and the fall of the power generation performance resulting from this were eliminated can be provided.

[Translation done.]

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TECHNICAL FIELD

[Industrial Application]This invention relates to the cellular structure which prevents the excessive humidity of the oxidant electrode in the solid polyelectrolyte type fuel cell stack which used solid polymer membrane as an electrolyte membrane, and the solid polyelectrolyte type fuel cell stack which receives supply of the reactant gas humidified especially beforehand.

[Translation done.]

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PRIOR ART

[Description of the Prior Art]Drawing 5 is a sectional view [-izing / **/ the single-cell-structure of a solid polyelectrolyte type fuel cell / a sectional view / type / in which showing it] and and, and the single cell 1 comprises the solid polymer membrane 2 which has ion conductivity, and the fuel electrode (anode electrode) 3 and the oxidant electrode (cathode terminal) 4 which were supported so that it might stick to the both sides. The bipolar plate 5 which pinches the single cell 1 consists of a gas impermeability board which has conductivity, By supplying oxygen (or air) as an oxidizer to the oxidizing agent passage 7 formed in the fuel gas passage 6 formed in the field side which touches the fuel electrode 3 as a concave as a concave in hydrogen as fuel gas at the field side which touches the oxidant electrode 4, Power generation based on electrochemical reaction is performed by inter-electrode [of the couple of the single cell 1]. Since the output voltage of the single cell 1 constituted in this way is as low as less than 1V, the solid polyelectrolyte type fuel cell (stack) of desired output voltage is obtained by the single cell 1, the bipolar plates 5A and 5B, etc. laminating 5 [two or more layers], and constituting a stack.
[0003]On the other hand as the solid polymer membrane 1 which has ion conductivity, For example, the thing using the perphloro carbon sulfonic acid film (the U.S., Du Pont, trade name Nafion) which is proton exchange membrane as an electrolyte membrane is known, While the specific resistance of 20 or less ohm-cm is shown and functioning as a proton conductivity electrolyte at ordinary temperature by having and carrying out the saturation water of the proton (hydrogen ion) exchange group into a molecule, it functions also as barrier membrane which prevents mixing of fuel gas and oxidant gas. Namely, the anode reaction ($H_2 \rightarrow 2H^+ + 2e^-$) which decomposes a hydrogen content child into a hydrogen ion and an electron in the anode electrode (fuel electrode) side, in the cathode terminal (oxidant electrode) side, water is generated from oxygen, a hydrogen ion, and an electron -- electrochemical reaction ($2H^+ + 1/2\ O_2 + 2e^- \rightarrow H_2O$) -- a cathode reaction being performed, respectively and, Electrochemical reaction which $2\ O_2 \rightarrow H_2O$ [$H_2 + 1/$] Becomes as a whole is performed, and generated output is supplied to load with the electron which moves toward a cathode in an external circuit from an anode.
[0004]As mentioned above, **********, While maintaining the inside of the solid polymer membrane 2 to a saturation moisture state in order to maintain highly the generation efficiency of a solid polyelectrolyte type fuel cell since a film functions as proton exchange membrane by carrying out the saturation water of the electrolyte membrane, It is necessary to hold the operating temperature of a solid polyelectrolyte type fuel cell to a 50-100 degreeC grade, and to keep the specific resistance of solid polymer membrane low. For this reason, after the solid polyelectrolyte membrane 2 of each single cell 1 has carried out the water of the water of a saturation content beforehand, assembly operation of a stack is performed. However, if it generates electricity by raising an operating temperature to the above-mentioned temperature requirement, the drying effect of the solid polymer membrane 2 shown below occurs, the solid polymer membrane 2 cannot be maintained to a saturation moisture state, but the problem that the generation efficiency of a solid polyelectrolyte type fuel cell

falls will occur. Namely, while the water generated by electrochemical reaction with fuel gas and oxidant gas is carried out out of a system, When proton $2H^+$ generated in the anode reaction turns the inside of solid polymer membrane to a cathode from an anode and moves, desiccation of solid polymer membrane advances by a child's water carrying out orientation to a proton several minutes, moving to it together, and being carried out out of a system with fuel gas and oxidant gas.
[0005]Then, in order to avoid such a situation, the reactant gas (fuel gas and oxidizer) supplied to the reactant gas passages 6 and 7 is humidified, the steam concentration (steam partial pressure) in reactant gas is raised, and what was constituted so that evaporation of the moisture from the solid polymer membrane 2 might be suppressed is known. drawing 6 is a block diagram showing the humidification method of reactant gas -- the exterior of the solid polyelectrolyte type fuel cell stack 10 -- or the humidifying section 11 is formed adjacently and fuel gas or oxidant gas is humidified, and it is constituted so that each single cell may be supplied as the humidification fuel gas 9F or the humidification oxidant gas 9A.
[0006]

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EFFECT OF THE INVENTION

[Effect of the Invention]It constituted from this invention so that the water-of-condensation elimination means which supplies unhumidified oxidant gas in the middle of the channel of an oxidizing agent passage might be established as mentioned above.
Therefore, since the dry oxidant gas supplied from a water-of-condensation elimination means is added to oxidant gas damp from the upstream and reduces the steam partial pressure in downstream oxidant gas from this, While the problem of the conventional technology that the moisture in oxidant gas will be in a supersaturation state when the water generated to the oxidant electrode side by the electrode reaction is added to humidification oxidant gas is canceled and being able to prevent condensation of the moisture to the internal surface of an oxidizing agent passage, It is urged to evaporation of the water of condensation, and the reliable solid polyelectrolyte type fuel cell with which the supply obstacle of the oxidant gas to an oxidant electrode catalyst bed and the fall of the power generation performance resulting from this were eliminated can be provided.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]As a solid polyelectrolyte type fuel cell shown also in the above-mentioned reaction formula, when the solid polymer membrane of proton conductivity is used as an electrolyte membrane, While being generated by produced water in the oxidant electrode (cathode) side, a child's water carries out orientation to a proton several minutes, and it moves towards an oxidant electrode (cathode) from a fuel electrode (anode). For this reason, in the conventional solid polyelectrolyte type fuel cell which supplies the humidification fuel gas 9F and the humidification oxidant gas 9A. In the downstream of an oxidizing agent passage, since the produced water by which it is generated in the upstream is added to the humidification oxidant gas 9A, the moisture in the oxidant gas with which moisture became superfluous and was in the supersaturation state condenses to things, and the oxidizing agent passage 7 side adheres to them at the internal surface of the oxidizing agent passage 7. As a result, it is blockaded by the moisture which the hole of the base material layer of the oxidant electrode 4 which should be gas permeation nature essentially condensed, the supply obstacle of oxidant gas is encountered, there is a problem that the power generation performance of a solid polyelectrolyte type fuel cell falls owing to this, and the improvement is called for.
[0007]The purpose of this invention is to prevent the supply obstacle of oxidant gas, and the fall of the power generation performance resulting from this by preventing condensation of the moisture in the oxidizing agent passage downstream.

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MEANS

[Means for Solving the Problem]A single cell which consists of a fuel electrode and an oxidant electrode which were arranged by sticking to solid polymer membrane which has ion conductivity, and its both sides according to this invention in order to solve an aforementioned problem, It consists of a stack which laminated by turns a bipolar plate which has a fuel gas passage and an oxidizing agent passage which were formed in both sides of a gas impermeability board as a concave, In what was formed so that desiccation of said solid polymer membrane which supplies fuel gas and oxidant gas which were humidified beforehand, and is generated during operation from an entrance-side cell manifold of said fuel gas passage and each oxidizing agent passage might be prevented, It has a water-of-condensation elimination means which supplies unhumidified oxidant gas in the middle of a channel of said oxidizing agent passage.
[0009]A water-of-condensation elimination means shall consist of a cell manifold formed in the direction which crosses an oxidizing agent passage at a bipolar plate, and an entrance-side header of a couple which penetrates a seal part of a stack to a laminating direction with a tee which is open for free passage at the end. A circulating hole of unhumidified oxidant gas with which a water-of-condensation elimination means was formed in a bipolar plate in the direction which crosses an oxidizing agent passage, Let a seal part of a stack be a becoming thing which consists of a header penetrated to a laminating direction with a tee which is open for free passage to both ends of a jet hole formed so that it might be distributed over the longitudinal direction and might be open for free passage to an oxidizing agent passage, and said circulating hole.

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OPERATION

[Function]By having constituted so that the water-of-condensation elimination means which supplies unhumidified oxidant gas in the middle of the channel of an oxidizing agent passage might be established in the composition of this invention, Since the dry oxidant gas supplied from a water-of-condensation elimination means is added to oxidant gas damp from the upstream and reduces the steam partial pressure in downstream oxidant gas from this, While the supersaturation state of oxidant gas is canceled and being able to prevent condensation of the moisture to the internal surface of an oxidizing agent passage, it is urged to evaporation of the water of condensation, and the function to prevent the supply obstacle of the oxidant gas to an oxidant electrode catalyst bed is obtained.
[0011]If a water-of-condensation elimination means is constituted from a header which penetrates a seal part to a laminating direction, and a cell manifold which consists of a concave which was open for free passage to this, By change of some of concaves beforehand formed in a bipolar plate, and header holes, a water-of-condensation elimination means can be formed easily, without changing substantially the laminated structure of a solid polyelectrolyte type fuel cell.
[0012]Since the distribution supply of the dry oxidant gas can be carried out all over an oxidizing agent passage if constituted from a header which was open for free passage to the circulating hole of the unhumidified oxidant gas which has a jet hole which opens a water-of-condensation elimination means for free passage to an oxidizing agent passage, and its both ends, The steam partial pressure of oxidant gas is reduced uniformly, and the function to prevent condensation of moisture better is obtained.

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EXAMPLE

[Example]Hereafter, this invention is explained based on an example. Drawing 1 is a sectional view [-izing / **/ the cellular structure of the solid polyelectrolyte type fuel cell which becomes an example of this invention / a sectional view / type / in which showing it] and and, and the duplicate explanation is omitted by giving the same reference mark to the same component part as conventional technology below. The single cell 1 which joined the fuel electrode 3 and the oxidant electrode 4 to both sides of the solid polymer membrane 1 which has proton conductivity in drawing 1, The fuel gas passage 6, the entrance-side cell manifold 16, and the outlet side cell manifold 26 are formed in the bipolar plate 5A laminated at the fuel electrode side as a concave, The humidification fuel gas 9F is supplied to the fuel gas passage 6 via the entrance-side cell manifold 16, and while the hydrogen diffused in the fuel electrode contributes to an anode reaction, desiccation of solid polymer membrane is prevented by holding a steam partial pressure with high fuel gas. The oxidizing agent passage 7, the entrance-side cell manifold 27, and the outlet side cell manifold 27 are formed in the bipolar plate 5B laminated at the oxidant electrode side as a concave, The humidification oxidant gas 9A is supplied to the oxidizing agent passage 7 via the entrance-side cell manifold 17, and while the oxygen diffused in the oxidant electrode contributes to a cathode reaction, when the oxidant gas 9A holds a high steam partial pressure, desiccation of the solid polymer membrane in the upstream section of an oxidizing agent passage is prevented.
[0014]In the mid-position of the oxidizing agent passage 7 of the bipolar plate 5B laminated at the oxidant electrode side. The cell manifold 37 which consists of a concave formed in the direction which crosses an oxidizing agent passage, The water-of-condensation elimination means 30 which consists of the header 37A which is open for free passage to the both ends, and supplies the unhumidified oxidant gas 9D is formed, The unhumidified oxidant gas 9D is supplied in the oxidizing agent passage 7 via this water-of-condensation elimination means 30, When are generated by produced water in the upstream, and the oxidant gas 9D which moisture dried to the oxidant gas which became superfluous is mixed and the oxidant gas with which the steam partial pressure fell flows into the downstream, it is constituted so that the water of condensation may be prevented from adhering to the internal surface of the oxidizing agent passage 7.
[0015]Drawing 2 is a sectional view of the direction of A-A in drawing 2, and the top view and drawing 3 which looked at the bipolar plate in an example from the oxidizing agent passage side the oxidizing agent passage 7 of the bipolar plate 5B, Leave the seal part 8 to the peripheral part, and it is formed in an oxidizing agent passage as a concave which left the rib 18 for current collection, To the Mogami style side, the cell manifold 37 for unhumidified oxidant gas 9D supply in the middle of the outlet side cell manifold 27 and both at the entrance-side cell manifold 17 and lowest style side, It is formed as a concave deeper than an oxidizing agent passage, and when the both ends of each cell manifold are open for free passage to the headers 17A, 27B, and 37A formed in the seal part 8 as a hole which penetrates a stack in a laminating direction, supply of oxidant gas and discharge are attained.
[0016]In the solid polyelectrolyte type fuel cell stack which has the water-of-condensation elimination means constituted in this way, The humidification oxidant gas 9A is distributed to the cell manifold 17

of each single cell 1 within the header 17A, flows into the oxidizing agent passage 7, and it will be in the state where it was generated by produced water and the moisture content increased gradually while the gas volume decreases gradually by consumption of oxygen. Then, the water-of-condensation elimination means 30 is formed in the upstream for how many minutes from the position from which the steam in oxidant gas will be in a supersaturation state, Since the steam concentration in oxidant gas can be reduced in the unsaturation state if the unhumidified oxidant gas 9D is distributed to the cell manifold 37 of each single cell by the header 37A and it mixes with the oxidant gas from the upstream in an oxidizing agent passage, While being able to prevent that moisture condenses and adheres to the internal surface of the oxidizing agent passage 7, and the supply obstacle of oxygen to the oxidant electrode 4 occurs owing to this, The already condensed water is evaporated and superfluous moisture can be discharged outside with off-gas via the cell manifold 27 and the header 27B of an outlet side.
[0017]Distribution of the moisture content in the oxidant gas in an oxidizing agent passage, Since it changes with the electrode area of the single cell 1, the amount of supply of the humidification oxidant gas 9A, or its humidified states, the position of the water-of-condensation elimination means 30, and the amount of supply of the unhumidified oxidant gas 9D, It may be constituted so that the distribution state of the moisture content in the oxidizing agent passage 7 may be taken into consideration, and an optimal position and quantity may be decided and it may provide in two or more places if needed.
[0018]Drawing 4 is a top view of the bipolar plate in which the example from which this invention differs is shown, The header 47A for unhumidified oxidant gas 9D supply to which the water-of-condensation elimination means 40 formed in the bipolar plate 45B by the side of an oxidant electrode penetrates a stack to the laminating direction, The circulating hole 47 of the unhumidified oxidant gas 9D formed in the edgewise direction in the bipolar plate 45B at tunnel form so that both ends might be open for free passage to this, By the point which comprised the jet hole 48 of the unhumidified oxidant gas distributed and formed in the longitudinal direction differing from the above-mentioned example, and constituting in this way, The unhumidified oxidant gas 9D which was distributed in the oxidizing agent passage and blew off is well mixed with oxidant gas damp from the upstream, the steam partial pressure of oxidant gas is reduced uniformly, and the advantage which can ensure generating and removal of the water of condensation is acquired.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The sectional view [-izing / **/ the cellular structure of the solid polyelectrolyte type fuel cell which becomes an example of this invention / sectional view / type / in which showing it] and and
[Drawing 2]The top view which looked at the bipolar plate in an example from the oxidizing agent passage side
[Drawing 3]The sectional view of the direction of A-A in drawing 2
[Drawing 4]The top view of the bipolar plate in which the example from which this invention differs is shown
[Drawing 5]The sectional view [-izing / **/ the single-cell-structure of a solid polyelectrolyte type fuel cell / sectional view / type / in which showing it] and and
[Drawing 6]The block diagram showing the humidification method of reactant gas
[Description of Notations]
1 Single cell
2 Solid polymer membrane (proton exchange membrane)
3 Fuel electrode
4 Oxidant electrode
5A The bipolar plate by the side of a fuel electrode
5B The bipolar plate by the side of an oxidant electrode
6 Fuel gas passage
7 Oxidizing agent passage
8 Seal part
9A Humidification oxidant gas
9F Humidification fuel gas
9D Unhumidified oxidant gas
10 Stack
11 Humidifying section
16 Cell manifold (fuel gas inlet side)
26 Cell manifold (off-gas outlet side)
17 Cell manifold (oxidant gas entrance side)
17A Header (oxidant gas entrance side)
27 Cell manifold (off-gas outlet side)
27B Header (off-gas outlet side)
30 Water-of-condensation elimination means
37 Cell manifold (water-of-condensation elimination means side)
37A Header (unhumidified oxidant gas supply side)
40 Water-of-condensation elimination means
45B Oxidant electrode side bipolar plate
47 The circulating hole of unhumidified oxidant gas

47A Header (unhumidified oxidant gas supply side)
48 Jet hole

[Translation done.]